Regional Information Report No. 1J08-11

Preliminary Pre-Construction Survey Results of Herring Spawning Habitat Assessment and Monitoring at Cascade Point, Berners Bay

by

David L. Barto

March 2008

Alaska Department of Fish and Game **Division of Commercial Fisheries**

Symbols and Abbreviations

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Weights and measures (metric)

centimeter	cm
deciliter	dL
gram	g
hectare	ha
kilogram	kg
kilometer	km
liter	L
meter	m
milliliter	mL
millimeter	mm

Weights and measures (English)

cubic feet per second	ft^3/s
foot	ft
gallon	gal
inch	in
mile	mi
nautical mile	nmi
ounce	oz
pound	lb
quart	qt
yard	yd

Time and temperature

day	d
degrees Celsius	°C
degrees Fahrenheit	°F
degrees kelvin	K
hour	h
minute	min
second	s

Physics and chemistry

all atomic symbols	
alternating current	AC
ampere	A
calorie	cal
direct current	DC
hertz	Hz
horsepower	hp
hydrogen ion activity (negative log of)	pH
parts per million	ppm
parts per thousand	ppt, ‰
volts	V
watts	W

General

Alaska Administrative Code	AAC
all commonly accepted abbreviations	e.g., Mr., Mrs., AM, PM, etc.
all commonly accepted professional titles	e.g., Dr., Ph.D., R.N., etc.
at	@
compass directions:	
east	E
north	N
south	S
west	W
copyright	©
corporate suffixes:	
Company	Co.
Corporation	Corp.
Incorporated	Inc.
Limited	Ltd.
District of Columbia	D.C.
et alii (and others)	et al.
et cetera (and so forth)	etc.
exempli gratia (for example)	e.g.
Federal Information Code	FIC
id est (that is)	i.e.
latitude or longitude	lat. or long.
monetary symbols (U.S.)	$, ¢
months (tables and figures): first three letters	Jan,...,Dec
registered trademark	®
trademark	™
United States (adjective)	U.S.
United States of America (noun)	USA
U.S.C.	United States Code
U.S. state	use two-letter abbreviations (e.g., AK, WA)

Measures (fisheries)

fork length	FL
mideye-to-fork	MEF
mideye-to-tail-fork	METF
standard length	SL
total length	TL

Mathematics, statistics

all standard mathematical signs, symbols and abbreviations	
alternate hypothesis	H_A
base of natural logarithm	*e*
catch per unit effort	CPUE
coefficient of variation	CV
common test statistics	(F, t, χ^2, etc.)
confidence interval	CI
correlation coefficient (multiple)	R
correlation coefficient (simple)	r
covariance	cov
degree (angular)	°
degrees of freedom	df
expected value	*E*
greater than	>
greater than or equal to	≥
harvest per unit effort	HPUE
less than	<
less than or equal to	≤
logarithm (natural)	ln
logarithm (base 10)	log
logarithm (specify base)	$\log_2$, etc.
minute (angular)	'
not significant	NS
null hypothesis	H_O
percent	%
probability	P
probability of a type I error (rejection of the null hypothesis when true)	α
probability of a type II error (acceptance of the null hypothesis when false)	β
second (angular)	"
standard deviation	SD
standard error	SE
variance	
population	Var
sample	var

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PRELIMINARY PRE-CONSTRUCTION SURVEY RESULTS OF HERRING SPAWNING HABITAT ASSESSMENT AND MONITORING AT CASCADE POINT, BERNERS BAY

By
David L. Barto
Alaska Department of Fish and Game, Division of Commercial Fisheries, Douglas

Alaska Department of Fish and Game
Division of Commercial Fisheries, Publications Section
802 3rd, Douglas, Alaska, 99824-0020

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David L. Barto,
Alaska Department of Fish and Game, Division of Commercial Fisheries,
802 3rd St., Douglas, AK 99824, USA

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ABSTRACT

Goldbelt, Inc. plans to construct a marine vessel terminal at Cascade Point to support the Kensington Gold Mine and other activities. This vessel terminal will include a rock breakwater and dredged area containing a floating dock. Because this proposed terminal is located in an area historically used for spawning by Pacific herring (*Clupea harengus*), construction will result in direct loss of spawning habitat in the dredge and fill footprint.

Underwater habitat monitoring surveys were conducted in 2005 and 2006 to document the pre-construction nearshore marine habitat at Cascade Point. A total of 9 different underwater transects were surveyed during the months of May and June. Observational data was collected using SCUBA to document the primary types of benthic substrate and vegetation within a 0.25 meter quadrat at 5-meter intervals along each transect. Vegetative coverage observations estimated the total percent cover of macroalgae and substrate within each quadrat. Vegetation and substrate type were recorded for the two most common types at each interval, with the most prevalent type reported as the primary observation.

Preliminary geo-referenced depth, substrate, and vegetation maps were developed using ArcMap GIS software to establish baseline area distributions at Cascade Point for this monitoring project. The next phase of the project will entail conducting surveys in future years to monitor habitat changes due to construction.

Key words: Pacific herring, *Clupea harengus*, spawning habitat, Southeast Alaska, habitat assessment

INTRODUCTION

In response to the planned operation of the Kensington Gold Mine, near the northern side of Berner's Bay, Goldbelt, Inc. plans to construct a marine vessel terminal at Cascade Point, approximately 75 km north of Juneau, Alaska (Figure 1). The marine vessel terminal will support the Kensington Gold Mine, as well as other activities. The proposed terminal will include a rock breakwater and a dredged area that will contain a floating dock (Figure 2).

The Alaska Department of Fish and Game (ADF&G) has some concerns about the proposed marine terminal. The project is located in an area historically used for spawning by Pacific herring (*Clupea harengus*). Terminal construction will result in a direct loss of spawning habitat in the dredge and fill footprint. Adjacent spawning habitat could also be affected, due to breakwater construction changing hydrology and sedimentation patterns within the area. Some of the damage may be ameliorated, if aquatic plants now at the site colonize the marine terminal area (for example, on the breakwater), in the years following the project's completion.

Compared to historical abundance, the Lynn Canal herring stock is presently at very low levels. Generally, this stock of fish spawned between April 18 and May 24, in the area between Berners Bay and Auke Bay. The Lynn Canal herring stock crashed in the late 1970s. The reason is unknown; possible causes include reduction of spawning habitat, overfishing, or elevated numbers of predators in the area. Other stocks in Southeast Alaska have declined and recovered, but the Lynn Canal stock has not recovered, and remains at one-tenth of the previous spawning biomass levels. The distribution of spawning grounds for this stock is presently limited to an area that includes the proposed marine terminal. Spawning grounds extend across the southern shore of Berners Bay, and the Point Bridget area. However, herring spawning activity has only been observed twice at Cascade Point during the past 10 years.

Southeast Alaska herring stocks spawn along the shoreline in select areas between mean high tide (MHHW) and approximately 40 feet below mean low tide (MLLW) from mid-March through mid-June. Immediately after release, eggs are extremely sticky and readily adhere to a

variety of intertidal and subtidal seaweeds, macroalgae and rocky substrates. Primary habitat for herring eggs in the Cascade Point area is macroalgae.

While the breakwater and the dredge basin will alter herring spawning habitat, the rocky substrate comprising the breakwater will likely be colonized by macroalgae (the preferred spawning substrate), and provide spawning habitat that would partially replace the habitat lost as a result of construction.

The goal of this project is to detect changes in the amount of available herring spawning habitat within and adjacent to the dredge and fill areas of the marine terminal. Additionally, this project will monitor the vegetative colonization of the breakwater and dredge basin areas. If herring do spawn in the area, the project will document the extent and abundance of the spawn within and adjacent to the dredge and fill area at Cascade Point prior to construction, and for a period of near Cascade Point.

This report presents the preliminary pre-construction survey results from 2005 and 2006.

OBJECTIVES

This monitoring project will attempt to document and addresses impacts associated with the construction and operation of the Cascade Point marine facility on herring spawning habitat within Berners Bay. While some details of the monitoring plan will differ between the pre-construction and operation phases, the monitoring objectives will remain the same for both phases.

1. Determine the annual occurrence, distribution and timing of herring spawning activity at Cascade Point within Berners Bay.
2. Monitor and document herring spawning within Berners Bay in the vicinity of Cascade Point.
3. Monitor and document the herring habitat colonization by aquatic vegetation and provided by the Cascade Point breakwater, dredged basin and adjacent shoreline compared to pre-construction conditions.

METHODS

DIVE OPERATIONS

On May 25, 2005 and July 3, 2006, ADF&G biologists conducted SCUBA dive surveys to document the habitat, also using outboard-powered skiffs. These dates are within the historical herring spawning periods observed for Berners Bay. U.S. Fish and Wildlife Service (USFWS) divers also participated in the 2005 survey effort, as observers. Due to delays in construction, both the 2005 and 2006 surveys took place in undisturbed conditions, and can be viewed as baseline studies for the Cascade Point terminal project.

SCUBA divers sampled the area by swimming along a series of transects laid out perpendicular to the shoreline at Cascade Point (Figure 3.). The transects extended from mean higher high water level (MHHW) to 13.7 m (45 feet) below the mean lower low water level (MLLW). Transect length varied, depending upon the slope of the bottom (Figure 4.). The longest transect surveyed (T4) was 265 meters long. The shortest transect (T6) was 55 meters. All surveyed transects reached their target depth. GPS latitude and longitude coordinates were recorded (using

a Garmin model 76) at the ending point of these surveys, to more accurately identify the transect locations in future years.

A total of 5 transects were surveyed in 2005; (Figure 3.). In the 2005 transects, a mid point transect (T3) was located along the axis of the breakwater footprint, one transect was located through the middle of the dredge basin (T4), two transects were located north of the breakwater (T1 and T2) and one transect to the south (T5) outside of the dredge basin.

Four transects were surveyed in 2006 (Figure 2). These transects (T6 through T9) were spaced to provide a higher resolution of coverage for the project area.

HABITAT SURVEY MONITORING BY DIRECT OBSERVATION

SCUBA divers collected data from 0.25 m^2 quadrats at 5-meter intervals along each transect. This type of habitat data is also recorded for the established herring spawn biomass assessment dive surreys by ADF&G (Pritchett 2007). Divers documented depth, vegetative group distribution, and substrate type, for all transects surveyed within the project area. Vegetative coverage observations estimated the total percent cover of macroalgae within a 0.25 meter quadrat. Substrate type was also identified within each quadrat sampled for vegetative cover. Vegetation and substrate type were recorded for the two most common types on each segment, with the most prevalent type reported as the primary observation. The beginning and ending times for each transect were recorded, to allow for standardization to MLLW.

Video Survey Method –Transects

The USFWS biologists used an underwater video camera to document the Cascade Point subtidal habitat was accomplished at T3 in 2005. One SCUBA diver would swim along the established transect, while a second diver would maintain a line transect heading, by referencing to a compass mounted on a dive survey rod alongside of the diver recording the video. The diver with the video camera attempted to maintain a constant distance above the bottom and a constant swimming speed.

Photoquadrats Survey Method – Transects

The divers conducted one subtidal transect from 13.7 m (45 ft) below MLLW to zero depth at the location of each of the five transects surveyed in 2005. A 35mm Nikonos underwater camera with a Sea & Sea 15mm underwater wide angle lens was used to photograph a 0.25 m^2 quadrat of the bottom along each line transect at the standardized 5-meter observation intervals. This photographic record was intended to record the different vegetation types and percent coverage encountered along the transect to verify the diver observations.

The results of the 2005 photo observations are currently being analyzed. An exposure problem occurred with the photographs. We are attempting to resolve this problem by converting the 35 mm photographic slides to digital files. Photographic software will be used to adjust the exposures if possible.

HERRING SPAWNING DOCUMENTATION AND BIOMASS MEASUREMENTS

In order to determine whether herring are spawning in Berners Bay, ADF&G biologists conduct aerial surveys from fixed-wing aircraft, beginning in early May, the historical start of herring spawning in the Berners Bay area. If herring are spawning in the area, ADF&G biologists identify the location and extent of the shoreline where active spawning is occurring. Aerial

surveys continue until active spawning is no longer observed, and herring schools are no longer staging on the spawning grounds.

RESULTS

Divers documented depth (Figure 5.), substrate type (Figure 6.), and vegetative group distribution (Figure 7.) for all transects surveyed within the project area. Substrate (Appendix A) and vegetation (Appendix B.) were recorded for the two most common types observed on each segment of the transect.

No herring spawn activity was observed at Cascade Point in 2005 and 2006 (Pritchett et al. 2007). Thus no herring spawn assessments were made.

Preliminary geo-referenced depth, substrate, and vegetation maps were developed using ArcMap GIS software to establish baseline area distributions at Cascade Point for this monitoring project. The next phase of the project will entail conducting surveys in future years to monitor habitat changes due to construction.

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Pritchett, M., S. Dressel, and K. Monagle. 2007. Berners Bay herring research for 2005 and 2006. Alaska Department of Fish and Game, Division of Commercial Fisheries Division RIR 1J07–01, Juneau.

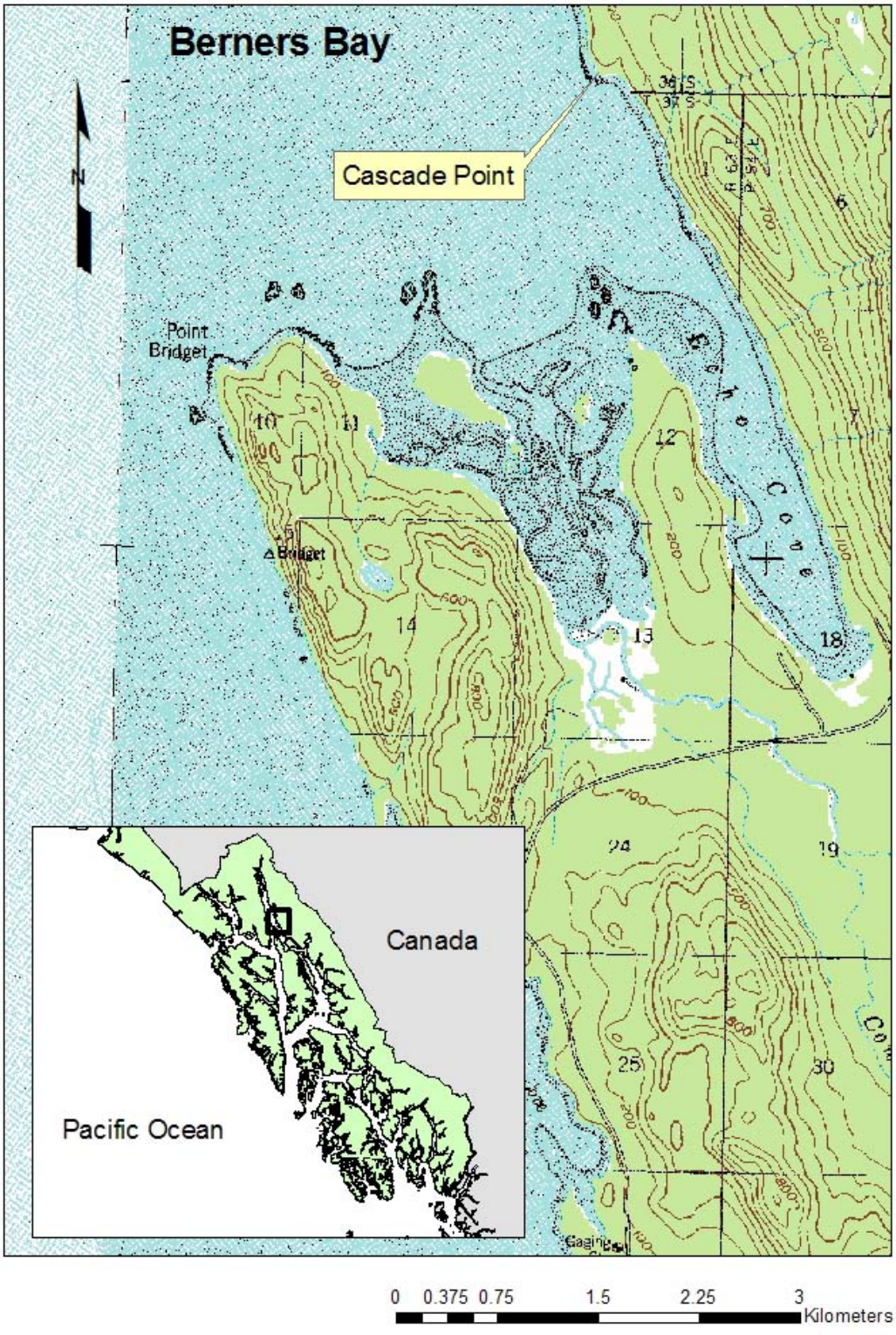

Figure 1.–Cascade Point study site location in Berners Bay north of Juneau, Alaska..

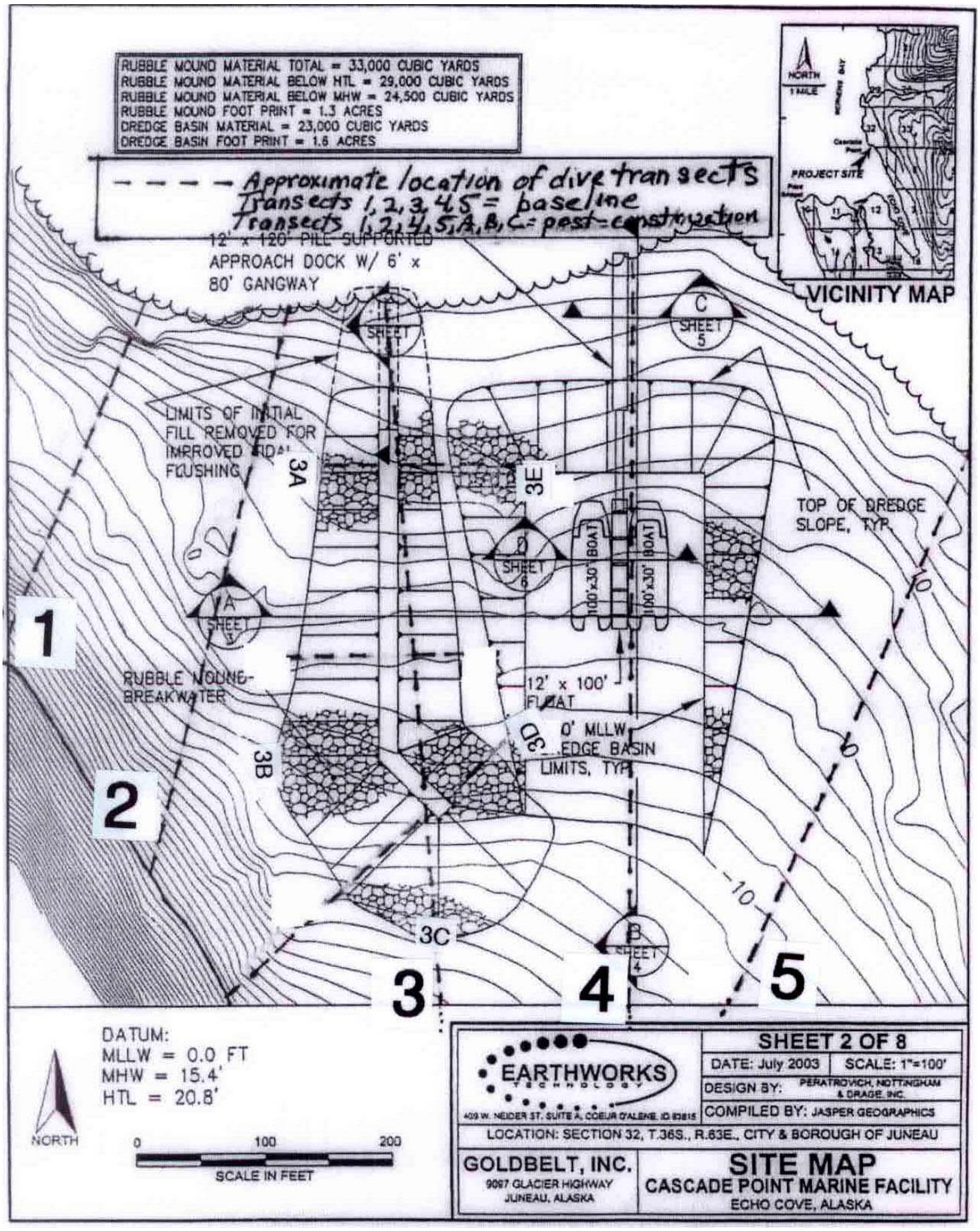

Figure 2.–Location of originally proposed herring spawn and habitat survey transects in the vicinity of the breakwater/dredge construction area at Cascade Point.

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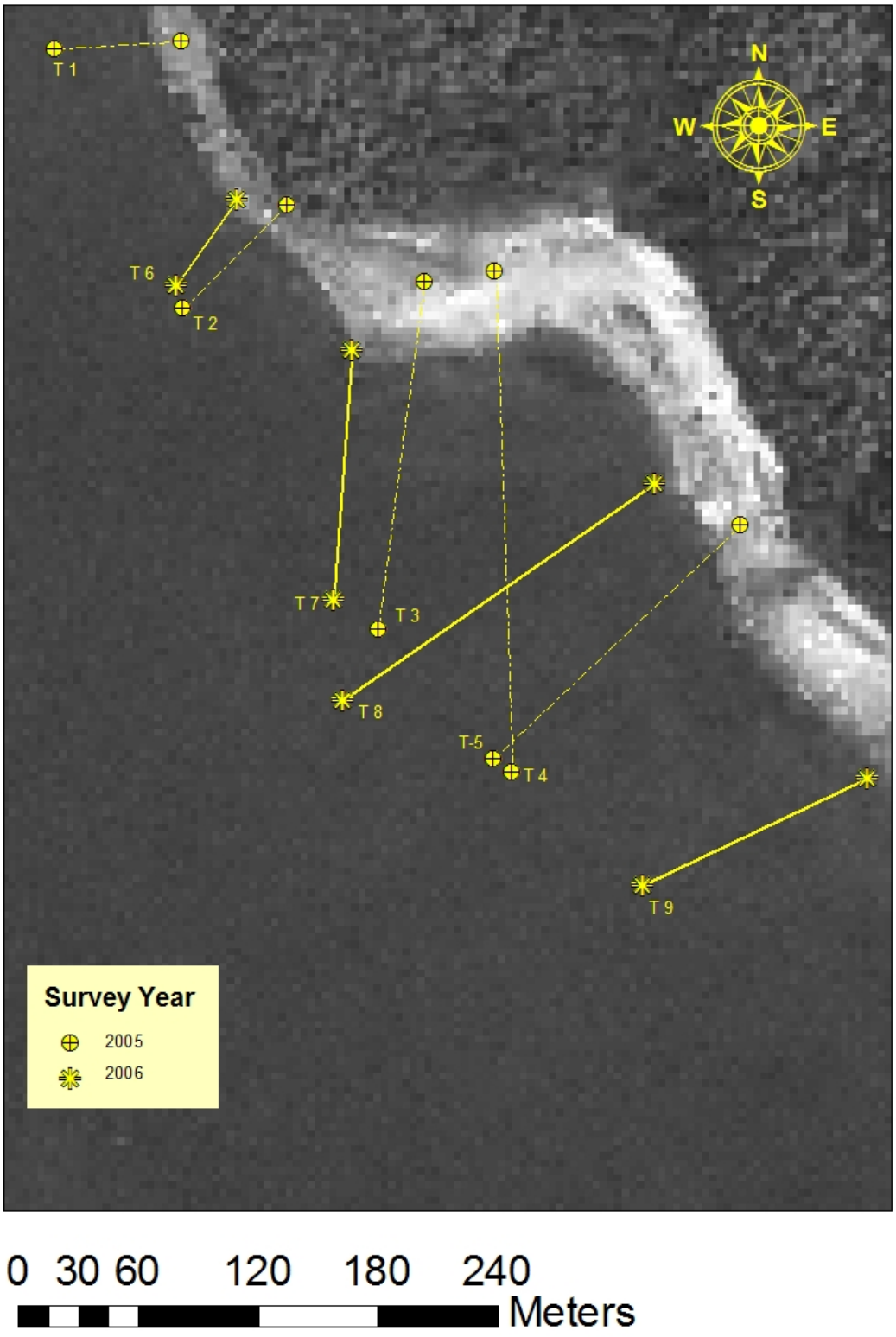

Figure 3.–Cascade Point 2005 and 2006 habitat dive survey transect locations

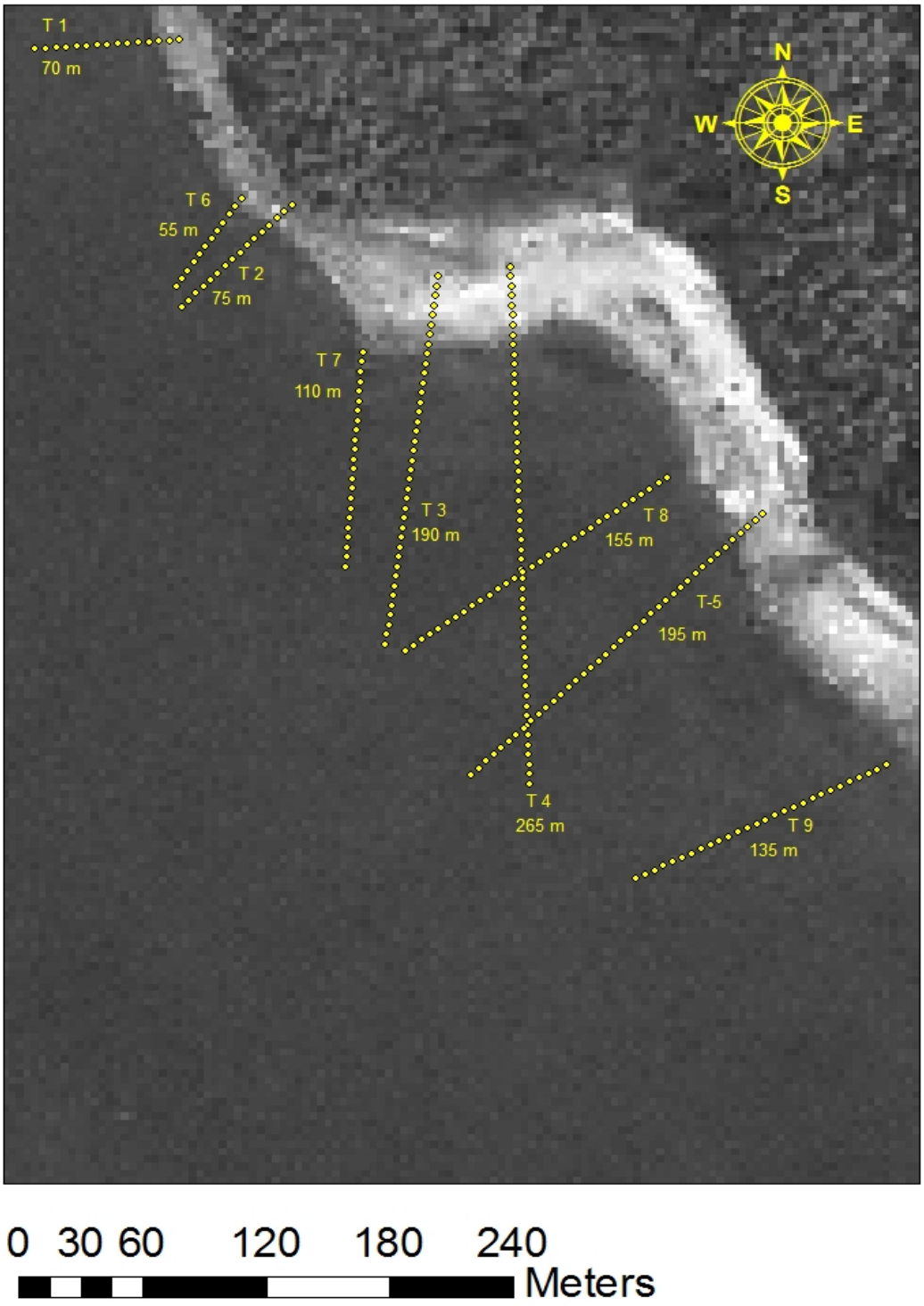

Figure 4.–Survey transect locations and lengths.

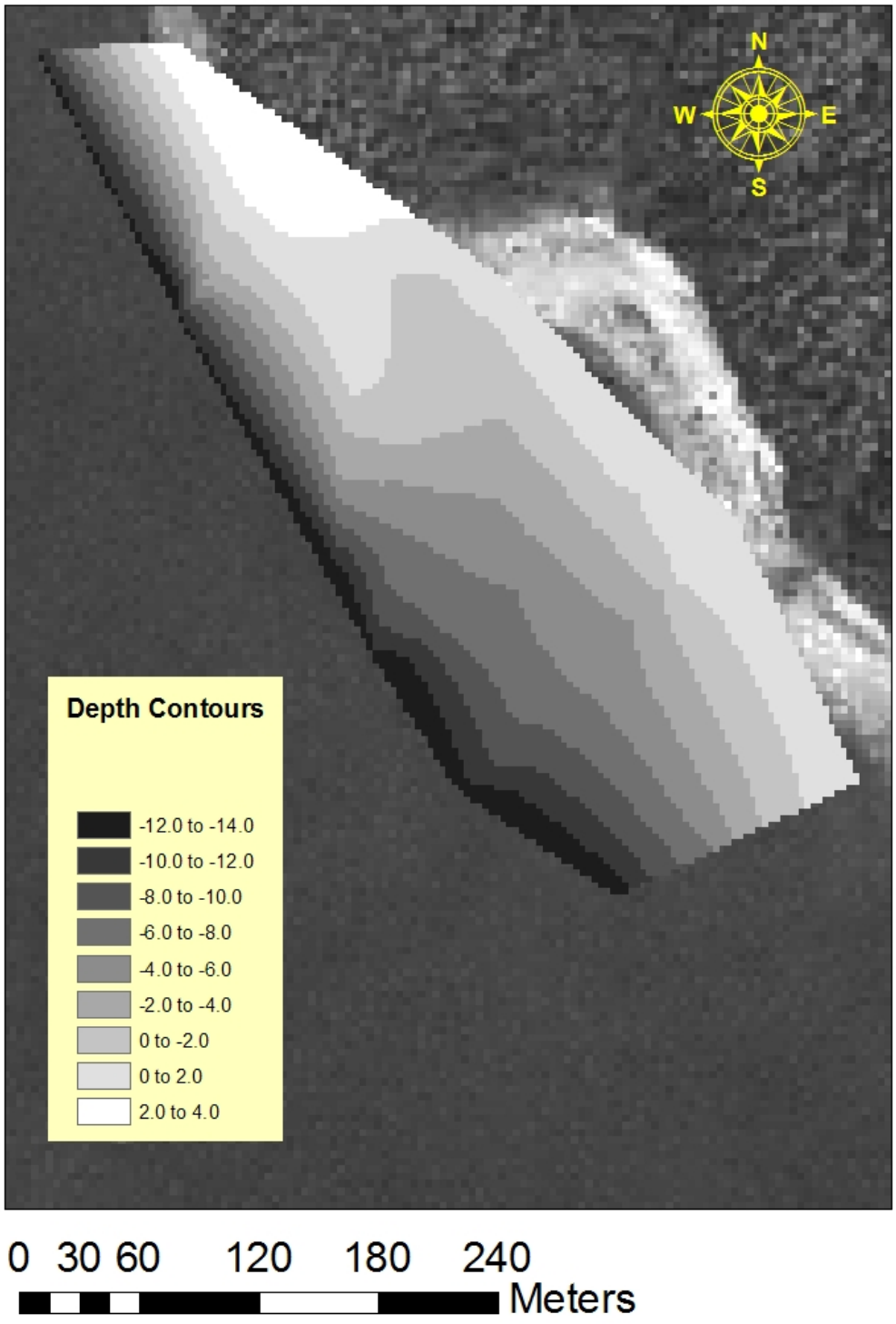

Figure 5.–Study area depth contours observed at Cascade Point during the 2005 and 2006 habitat surveys.

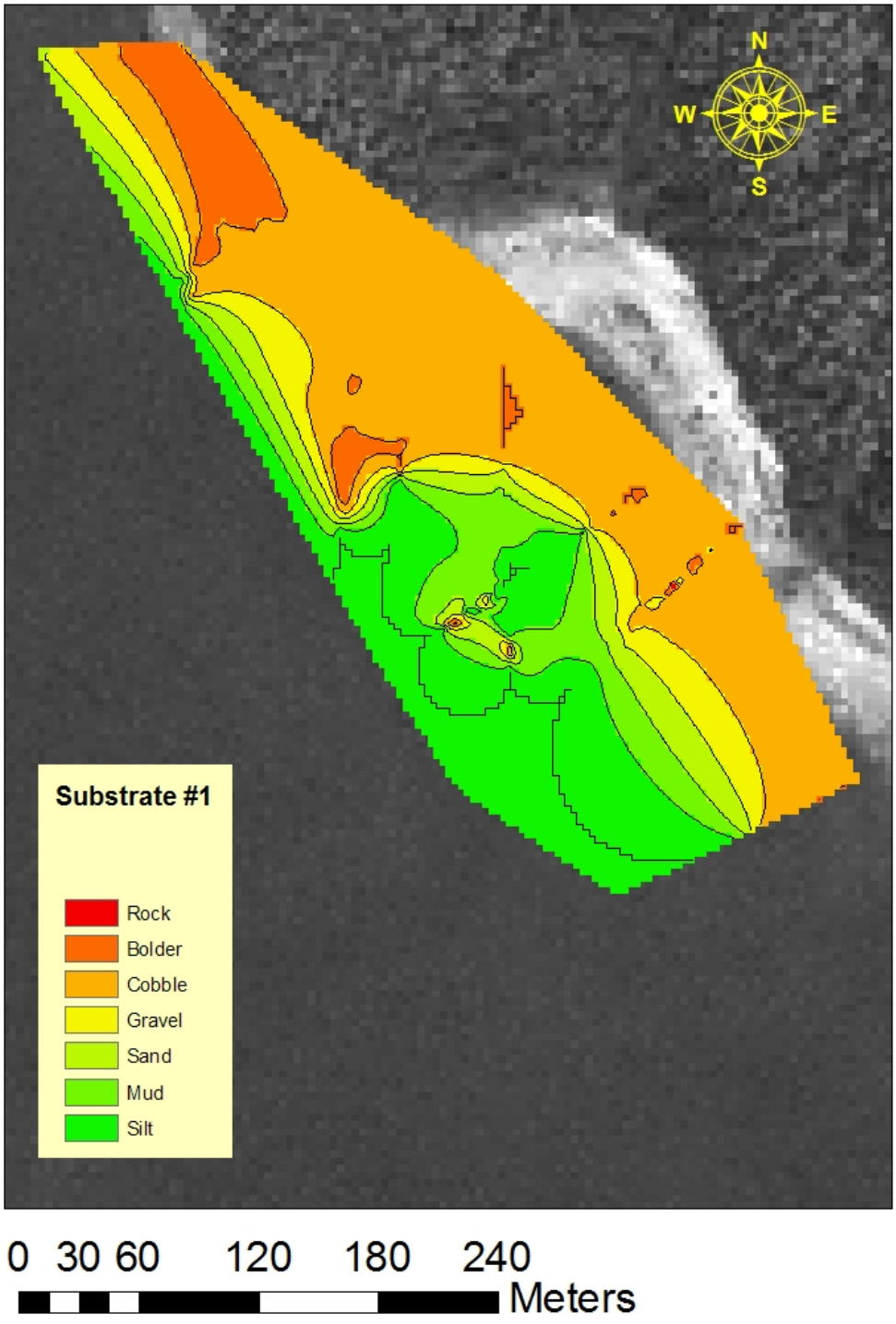

Figure 6.–Primary substrate distribution observed during 2005 and 2006 habitat surveys at Cascade Point.

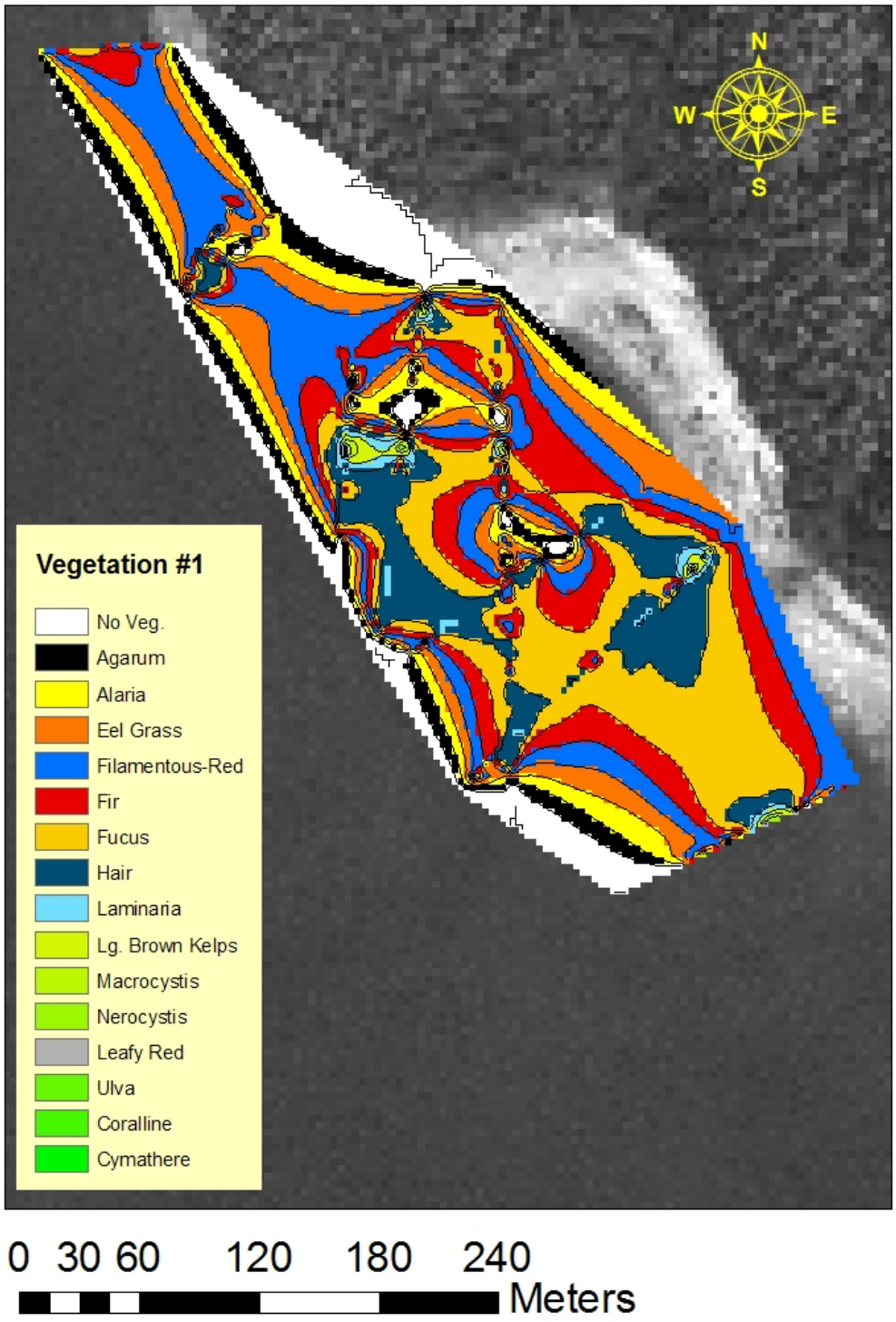

Figure 7.–Primary vegetation distribution observed during the 2005 and 2006 habitat surveys at Cascade Point.

APPENDICES

Appendix A.–Key to bottom types used for herring spawn deposition survey.

CODE	EXPANDED CODE	DEFINITION
RCK	Bedrock	Various rocky substrates > 1 meter in diameter
BLD	Boulder	Substrate between 25 cm and 1 meter
CBL	Cobble	Substrate between 6 cm and 25 cm
GVL	Gravel	Substrate between 0.4 cm and 6 cm
SND	Sand	Clearly separate grains of < 0.4 cm
MUD	Mud	Soft, paste-like material
SIL	Silt	Fine organic dusting (very rarely used)
BAR	Barnacles	Area primarily covered with barnacles
SHL	Shell	Area primarily covered with whole or crushed
MUS	Mussels	Area primarily covered with mussels
WDY	Woody debris	Any submerged bark, logs, branches or root

Appendix B.–Key to vegetative types used for herring spawn deposition survey

CODE	EXPANDED CODE	SPECIES INCLUDED	LATIN NAMES
AGM	Agarum	Sieve kelp	*Agarum clathratum*
ALA	Alaria	Ribbon kelps	*Alaria marginata, A. nana, A. fistulosa*
ELG	Eel grass	Eel grass, surfgrasses	*Zostera marina, Phyllospadix serrulatus, P. scouleri*
FIL	Filamentous red algae	Sea brush, poly, black tassel	*Polysiphonia pacifica, P. hendryi, Pterosiphonia bipinnata*
FIR	Fir kelp	Black pine, Oregon pine (red algae)	*Neorhodomela larix, N.oregona*
FUC	Fucus	Rockweed or popweed	*Fucus gardneri*
HIR	Hair kelp	Witch's hair, stringy acid kelp	*Desmarestia enestra, D. viridis*
LAM	Laminaria	split kelp, sugar kelp, suction-cup kelp	*Laminaria bongardiana, L. saccharina, L. yezoensis (when isolated and identifiable)*
LBK	Large Brown Kelps	Five-ribbed kelp, three-ribbed kelp, split kelp, sugar kelp, sea spatula, sieve kelp, ribbon kelp	*Costaria costata, Cymathere enestrate, Laminaria spp., Pleurophycus gardneri, Agarum, Alaria spp.*
MAC	Macrocystis	macrocystis	*Macrocystis integrifolia*
NER	Nereocystis	Bull kelp	*Nereocystis leutkeana*
RED	Red algae	All red leafy algae (red ribbons, red blades, red sea cabbage, Turkish washcloth)	*Palmaria mollis, P. hecatensis, P. callophylloides, Dilsea californica, Neodilsea borealis, Mastocarpus papillatus, Turnerella mertensiana*
ULV	Ulva	Sea lettuce	*Ulva enestrate, Ulvaria obscura*
COR	Coralline algae	Coral seaweeds (red algae)	*Bossiella, Corallina, Serraticardia*
CYM	Cymathere	Three-Ribbed kelp	*Cymathere triplicata*